

Application No. 09/606,884

40. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the vanadium oxide particles have an average particle size of no more than about 300 nm.

41. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the vanadium oxide particles have an average particle size of no more than about 200 nm.

42. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the vanadium oxide particles have a distribution in sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than 160 percent of the average diameter.

REMARKS

Claims 1, 4-11, 13-28 and 30-52 are pending. Claims 1, 4-11, 14, 20-28 and 30-37 are allowed. Claims 38-42 have been amended to obviate formal rejections. By correcting the antecedent reference in claims 38-42, Applicants do not intend to change the scope of the claims. No new matter has been introduced by this Amendment.

Currently, claims 15-19 and 38-42 stand as rejected under 35 U.S.C. § 112, and claims 47-52 stand as rejected under 35 U.S.C. § 102(a) and (e) as being anticipated by U.S. patent 5,549,880 to Koksang.

Rejections Under 35 U.S.C. § 112, First Paragraph

The Examiner rejected claims 15-19 and 38-42 under 35 U.S.C. § 112, first paragraph, asserting that the specification "does not reasonably provide enablement for batteries having

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nanoparticles of all metal oxides as cathode active materials." The Examiner also asserted that "the specification does not enable any person skilled in the art to which it pertains to, or with which it is most nearly connected, to make and use the invention commensurate with the scope of the claims." Applicants submit that the specification does enable one of skill in the art to make and use the invention commensurate with the scope of the claims. Applicants respectfully request reconsideration of the rejection based upon the following comments.

The standard for determining whether the scope of the claims is commensurate with the scope of enablement is whether a "reasonable correlation" exists between the scope of enablement and the scope of the claims. See MPEP § 2164.08. Furthermore, "the Federal Circuit has repeatedly held that 'the specification must teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation.'" See MPEP § 2164.08 (quoting In re Wright, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993)).

Applicants' specification discloses that metal oxide nanoparticles other than vanadium oxide, e.g., titanium dioxide nanoparticles, can be used as the cathode active material to intercalate lithium ions. See Applicants' specification, for example, at page 17, lines 25-29 and page 18, lines 15-22. Thus, Applicants' specification has enabled more than vanadium oxide nanoparticles as potential cathode active material. The application also describes the formation of various crystalline forms of vanadium oxide using laser pyrolysis. Furthermore, the specification provides the nanoparticle loading levels and suitable binding materials for making the cathodes and corresponding batteries that can be used with a variety of metal oxide nanoparticles. See specification, for example, at page 19, lines 12-19. Additionally, the specification provides a method of evaluating lithium based batteries comprising any appropriate metal oxide nanoparticles in the cathode, to determine if the electroactive material in the cathode exhibits an energy density greater than about 900 Wh/kg during discharge of the battery when

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discharged from 4 volts to 1.8 volts at 25°C. See the Example starting on page 21 of the specification. Working examples are also provided that exhibit the claimed energy densities.

Since the specification discloses metal oxide nanoparticles that can be used as the cathode active material and a method of evaluating the lithium batteries, the scope of the claims bears a "reasonable correlation" to the scope of enablement. Moreover, one skilled in the art could, based upon the Applicants' specification, make and use the full scope of the claimed invention without undue experimentation. Thus, the specification does enable one skilled in the art to make and use the invention commensurate with the scope of the claims.

Since the specification does enable one skilled in the art to make and use the invention commensurate with the scope of the claims, Applicants' respectfully request the withdrawal of the rejection under 35 U.S.C. § 112, first paragraph.

Rejections Under 35 U.S.C. § 112, Second Paragraph

The Examiner rejected claims 38-42 under 35 U.S.C. § 112, second paragraph, asserting that there is insufficient antecedent basis for the phrase "the collection of vanadium oxide particles." As amended, claims 38-42 have sufficient antecedent basis for the recited vanadium oxide particles. Applicants thank the Examiner for a careful review of the claims. Therefore, Applicants respectfully request the withdrawal of the rejection of claims 38-42 under 35 U.S.C. § 112, second paragraph.

Rejection Under Koksang

The Examiner rejected claims 47-52 under 35 U.S.C. § 102(a) and (e) as being anticipated by U.S. patent 5,549,880 to Koksang (the Koksang patent). More specifically, the Examiner asserted that the Koksang patent "discloses secondary lithium batteries comprising a lithium vanadium oxide cathode active material, a lithium metal anode, and either a polymer

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electrolyte separator or a solid electrolyte separator." Moreover, the examiner asserted that 0.1 to 5 micron particle range disclosed in the Koksbang patent is a range of average particle sizes. Applicants do not believe that the Koksbang patent can reasonably be interpreted as suggested by the Examiner, and as a result the Examiner has failed to establish prima facie anticipation of the claimed invention. Applicants respectfully request reconsideration of the rejection in view of the following comments.

The Examiner has the burden of establishing a prima facie case of anticipation. As such the Examiner must provide a reference that discloses every element as set forth in the claim, and "the identical invention must be shown in as complete detail as is contained in the...claim." See MPEP § 2131. The Koksbang patent discloses that the lithium vanadium oxide particles produced by their method "have a surprisingly small particle size on the order of 0.1 to 5 microns, and typically less than 10 microns." See column 5, lines 4-6 (emphasis added). The phrase "and typically less than 10 microns" suggests that the range language in the Koksbang patent is a range of particle sizes and not a range of averages since the interpretation of the range as average particle sizes renders the phrase "typically less than 10 microns" superfluous. A more reasonable interpretation is that the disclosed range from 0.1 to 5 microns is a range of particle sizes.

Further evidence that the above-mentioned range is not reasonably interpreted as an average results from the lack in the description in the patent of a way to vary the average particle size. If the described range is a range of particle sizes and not a range of average particle sizes, there would be no need to explain how to vary the particle size. One of ordinary skill in the art would expect that if the range language in the Koksbang patent were a range of averages, there would be a disclosure of various process conditions that would allow one of ordinary skill in the art to select a desired value of average particle size. However, the Koksbang patent does not disclose methods of varying the process conditions in order to select desired average particle

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sizes. Since the Koksbang patent fails to disclose methods of varying the process conditions to select a desired average particle size, this strongly implies that the range statement in the Koksbang patent is a range of particle sizes.

In addition, the Koksbang patent's Example at column 5, lines 4-6 repeats the language about the particle size range. Since the Example recites essentially one set of conditions, it is difficult to imagine that one set of conditions can yield an average particle size varying over a factor of 50. It would be even more difficult to understand if the average particle size varied by a factor of 50 under the conditions specified in the example without any comment in the patent on the very large variation in the particle size. Thus, it is unreasonable to interpret the ranges in the Koksbang patent as a range of average particle sizes.

As noted in a previous communication, the range of particle sizes in the Koksbang patent results in an average particle size of roughly 2.4 to 2.5 microns. In response, the Examiner asserted that "the average particle size would depend upon the details of the particle size distribution." However, Applicants submit that nothing in the Koksbang patent suggests that the particle distribution does not follow something approximating a normal distribution. Most particle synthesis approaches produce an approximately normal distribution of particle sizes unless, as with Applicants' approach, there is a specific design feature in the approach to generate a different type of distribution. The range presented in the Koksbang patent would represent some arbitrary cut off of an approximately normal distribution. With this expected behavior, it follows that the average particle size of the Koksbang particles is about 2.4 to 2.5 microns. In contrast, Applicants' invention, as claimed in independent claim 47, relates to vanadium oxide particles having an average diameter of from about 5 nm to about 500 nm, which is less than 1 micron. Therefore, because the Koksbang patent fails to disclose this feature of Applicants' claimed invention, the Examiner has failed to establish prima facie anticipation.

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Since the Koksbang patent does not prima facie anticipate Applicants' claimed invention, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. § 102(a) and (e) of claims 47-52 as being anticipated by the Koksbang patent.

CONCLUSION

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,



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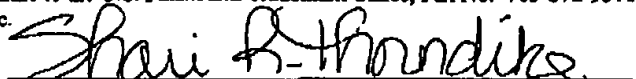
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ATTACHMENT
REDLINED AMENDMENTClaims As Amended

Please substitute the following amended claims for those currently pending:

38. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the [collection of] vanadium oxide particles have [has] an average particle size of no more than about 500 nm.

39. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the [collection of] vanadium oxide particles have [has] an average particle size of no more than about 400 nm.

40. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the [collection of] vanadium oxide particles have [has] an average particle size of no more than about 300 nm.

41. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the [collection of] vanadium oxide particles have [has] an average particle size of no more than about 200 nm.

42. (Amended) The battery of claim 15 wherein the nanoparticles comprise vanadium oxide particles and wherein the [collection of] vanadium oxide particles have [has] a distribution in sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than 160 percent of the average diameter.